THE EXTENDED DELAUNAY TESSELATION FOR MOVING GRIDS IN LAGRANGIAN FLOWS

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Solution of many problems in computational mechanics requires the continuous generation of a grid on the basis of a fixed distribution of nodes. Typical examples of this situation are found in lagrangian flows and in many meshless procedures [1].

This paper presents an efficient procedure to generate a computational grid from a given set of nodes using an extension of the standard Delaunay method. The so-called Extendend Delaunay Tesselation (EDT) [2] leads to a partition of the analysis domain into standard finite element shapes and non-standard polyhedra without the need of introducing new nodes or changing the position of the existing ones. This makes the EDT a suitable unstructured grid generation technique for problems where the nodal connectivity is the only information available for the updating of the mesh. It is worth mentioning that the new EDT method does not require any expensive smoothing process.

The paper describes the basis of the EDT method as well as the procedure for selecting the shape functions of the non standard elements introduced by the EDT technique (such as pentagons in 2D or pentahedra and heptahedra in 3D) using non-Sibsonian interpolations. It is shown that the number of non standard polyhedra generated is relatively small with respect to standard finite elements. The different matrices and vectors of all element types can be effectively computed using the standard finite element methodology. Details of a mesh quality indicator proposed are also given. Examples of the efficiency of the EDT method are shown in the analysis of a number of 2D/3D incompressible lagrangian flow problems, solved with four node tetrahedra and non standard polihedra using a stabilized formulation allowing equal order interpolation for the velocity and pressure variables, are given.

References

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